Student Achievement in Charter Schools: A Complex Picture

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Abstract

Since the inception of charter schools over a decade ago, policymakers have wanted to know how charter schools are performing. This is difficult to answer because there is no single charter school approach to educating students. By design, charter schools have innovative and distinctive education philosophies. In this research, we capture some of the uniqueness of charter schools by clustering them into four major categories: charter schools that convert from conventional public schools, charter schools that start from scratch, charter schools that rely primarily on classroom-based instruction, and charter schools that have a significant portion of instruction outside of the classroom. Based on these four distinctions, we find significant differences in performance. These differences suggest that policymakers may want to focus greater resources on certain types of charter schools versus others. © 2005 by the Association for Public Policy Analysis and Management.

INTRODUCTION

In the education community, few issues provoke as much debate as charter schools, which are publicly funded schools that operate outside the direct control of conventional school districts and are under the authority of a quasi-contract, or "charter," granted by a public body. Supporters hope that charter schools, with their greater autonomy, will be able to cut through red tape and encourage innovative reforms, provide new options to families, and promote healthy competition (Finn, Manno, & Vanourek, 2000; Nathan 1998a; 1998b). Opponents argue that charter schools have not been shown to be more effective, and that greater choice may exacerbate current racial segregation and create fiscal strains for states and school districts (Wells et al., 1998; Fiske & Ladd, 2000; Lacireno et al., 2002). Despite this debate, charter schools have grown from the first school in Minnesota in 1992 to nearly 3,000 schools with over 680,000 students in 37 states plus the District of Columbia.[1] Nowhere is this growth more apparent than in California, which in 1992 became the second state to pass charter-school legislation. California now has more charter school students than any other state and ranks second only to Arizona in the number of charter schools.

[1] Center for Education Reform (www.edreform.com).

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Because of the sheer number of charter students and schools, California is a pivotal state in the charter debate and is the focus of this current research.

Even with charter schools' growth, researchers have not come to a consensus about their performance (Gill et al., 2001). One of the challenges of assessing charter performance is that there is no single charter school approach. By design, charter schools vary in their educational programs, curricula, instruction, and school settings. In the past, researchers have generally treated charter schools as a homogenous group, which masks the variation of performance among them. In this paper, we examine the performance of different types of charter schools and show that some types of charters are having more classroom success than others.

CALIFORNIA CHARTER SCHOOL OVERVIEW

In California, some charters are "conversions" and others are "startup" charter schools. Conversion schools are schools that previously existed as conventional public schools and they typically retain an existing facility as well as faculty and students when they become charter schools. Startup schools, by contrast, are new entities that acquire facilities, faculty, and students at their inception. In addition, the motivation to start charter schools may differ between these types of charter schools. As part of a larger study of charter schools (Zimmer et al., 2003), case studies of nine charter schools, including both conversion and startup schools, were conducted. In these visits, conversion schools typically suggested that they became charter schools to reduce their bureaucracy from the districts and to change specific educational programs. In some cases, the conversion schools suggested that they did not like a particular mandated curriculum program, and this was a major motivation for the conversion. Startup schools, on the other hand, were often initiated to create a new holistic approach to schools, including curriculum programs, instructional practices, governance structures, and overall mission of the schools. Because startups typically depart more from traditional educational programs than conversion schools, we may expect to see greater differences between startup and conventional public schools than between conversion and conventional public schools.

Charter schools in California also use two distinct instructional approaches—most rely exclusively on instruction in traditional classroom settings, but some make extensive use of nonclassroom settings, such as homeschooling, independent study, and distance learning. Charter schools that use traditional classroom instruction are more likely to have similar curricula and operation than schools that have a significant portion of student's time outside of a classroom. Thus, we may see significant differences in the performance classroom- and nonclassroom-based schools.

Because many readers may not be familiar with nonclassroom-based charter schools, we take a few moments to describe these schools in greater detail. The California Department of Education (CDE) (2003) defines charter schools as nonclassroom-based "when a school does not require attendance of its pupils be at the school site under the direct supervision and control of a qualified teaching employee of the school for at least 80 percent of the required instructional time."[2,3] Schools are considered classroom-based when:

[2] http://www.cde.ca.gov/charter/regs/sb740covlet0203df.htm

[3] A list of California's nonclassroom-based charter schools can be found at http://www.cde.ca.gov/charter/whatsnew/SBEfundingdeterminations0102.pdf

1. "The charter school's pupils are engaged in education activities required of those pupils, and the pupils are under the immediate supervision and control of an employee of the charter school who is authorized to provide instruction to the pupils within the meaning of Education Code Section 47605(l);
2. At least 80 percent of the instructional time offered at the charter school is at the school site;
3. The charter's school site is a facility that is used principally for classroom instruction; and
4. The charter school requires its pupils to be in attendance at the school site at least 80 percent of the minimum instructional time required pursuant to Education Code Section 47612.5(a)(1)."

As evident from these definitions, not all students who attend a nonclassroom-based charter school will be instructed in nonclassroom settings and vice versa. Additionally, some students may spend part of their day in a classroom setting and part of the day receiving nonclassroom instruction such as homeschooling, independent study, and distance learning, but the school can still be considered a nonclassroom-based charter school if the school reaches a 20 percent threshold of outside instruction.

Of all charter schools, startup schools are much more likely to be nonclassroom-based (56.5 percent compared to 11.4 percent for conversion charter schools).[4] Breaking the proportion of nonclassroom-based students across different grades, students at nonclassroom-based schools make up 17 percent of elementary charter students and 41 percent of secondary charter students.[5]

Currently, 61 percent of California's nonclassroom-based charter schools provide some classroom-based instruction and are often referred to as "hybrid" schools. An additional 23 and 16 percent are exclusively independent study and home school charter schools, respectively. In all three cases, these schools typically rely heavily upon computer instruction and, in many cases, parents are the primary instructor with oversight provided by teachers employed by the schools. The instructional oversight could include visits to homes, one-on-one meetings with parents and/or students, monitoring progress of homework, collecting reports, and administering tests.

In addition to their differences in educational philosophies, charter schools differ in their pattern of expenditures. Table 1 shows that nonclassroom-based charter schools spend significantly less than classroom-based charter schools, while conversion schools spend slightly more than startup schools. The table also shows that startup schools allocate 44 percent of total expenditures to teacher compensation as compared to 51 percent for conversion schools. In part, this difference reflects the allocation of startup schools' funds to facilities costs.[6] These differences in expenditures may have implications in school performance, since resource limitations may impede the educational program at some schools.

[4] Most likely, these conversion nonclassroom-based charter schools only have a portion of their instruction outside the classroom or a portion of their students receiving nonclassroom-based instruction. Presumably, this dimension was added to the school after the school converted to a nonclassroom-based charter school.

[5] These percentages represent the percentage of students attending a school that offers some component of nonclassroom-based instruction. Many of these students will also have classroom-based instruction.

[6] Sugerman (2002) suggests that startup schools often have to redirect as much as 20 percent or more of their core funding to pay for space.

Table 1. Charter school expenditures per pupil, 2001–2002.

	Expenditures Per Pupil		
Type of Charter School	Total	Teacher Compensation	Other Staff Compensation
All charter schools	$6,204	$2,841	$1,075
Startup	$6,168	$2,729	$1,006
Conversion	$6,366	$3,237	$1,340
Classroom-based	$6,926	$3,233	$1,315
Nonclassroom-based	$4,973	$2,217	$720

Source: 2002 RAND Charter School Supplemental Survey.

The success of various types of charters in California has implications for the charter school movements in other states. Currently, 35 out of the 37 states that have charter schools explicitly allow both startup and conversion schools, for which our analysis will have direct implications. In contrast, only two states (California and Alaska) explicitly allow some version of nonclassroom-based charter schools, but these schools exist in an additional five states that do not explicitly outlaw nonclassroom-based schools. A number of other states have engaged in a process to define nonclassroom-based charter schools legislatively to avoid ambiguities in their laws (Huerta & Gonzalez, 2004). For those states that currently have nonclassroom-based charter schools and for those states currently trying to define these schools legislatively, our analysis of nonclassroom-based schools has policy implications. Furthermore, it is important that our analysis breaks down conversion and startup schools by nonclassroom- and classroom-based charter schools so that direct comparison can be made to those states that have only classroom-based conversion and startup schools.

In addition to the above categorizations, we also examine whether charter performance varies with the age of the school. Schools are complicated ventures, so starting charter schools or even making significant changes to a preexisting school can create real challenges. These challenges may translate into an erratic performance for schools in their initial years (Hanushek, Kain, & Rivkin, 2002). Also, poorly conceived and planned charter schools may not survive the first few years, so we may expect performance to differ between mature and new charter schools. These differences may be more pronounced where the complexity of operating schools and the experience of their leaders and teachers differ (Zimmer et al., 2003).[7] Thus, we break down charter schools by age into mature and new charter schools generally and by the classifications defined above.

LITERATURE REVIEW

The inception of charter schools has created a firestorm of public debate that only recently has been informed by research, including assessments of charter school student performance. Much of this research has relied upon school-level data

[7] Evidence from other studies of charter schools (Finn, Manno, & Vanourek, 2000) suggests that startup charter schools face different, and often greater, challenges than do conversion charters in providing instruction for students.

(Miron, Telson, & Risley, 2002; Rogosa, 2003; Greene, Forster, & Winters, 2003). A key weakness of a school-level analysis is the high degree of aggregation, which masks changes over time in the school's population of students, and variation of performance across different subjects and grades. In essence, school-level data may not pick up the nuances of school characteristics and can only provide an incomplete picture of why outcomes can vary across schools. Analysis of student-level data allows researcher to disentangle school performance from the mix of students attending a school from year to year. In addition, using fixed-effect estimation approaches, student-level data can help alleviate selection issues that plague evaluations of school choice programs, such as charter schools.[8] To date, only seven student-level studies of charter schools in five states (Arizona, California, Michigan, North Carolina, and Texas) have been completed and generally found mixed results.

Solmon, Paark, and Garcia (2001) use longitudinally linked student-level data to track student achievement in Arizona charter schools. The authors find that students spending two to three years in charter schools outperformed conventional public school students. The study also shows that students do poorly in their first year in charter schools, which the authors suggest may be a mobility effect rather than a charter effect. Over time, students do perform better as they increase their tenure in charter schools.

Two separate studies using longitudinally linked student-level data find mixed results in Texas. Grønberg and Jansen (2001) uses individual fixed effects to control for prior test scores, along with school-level demographic factors, to examine student test scores on Texas Assessment of Academic Skills (TAAS) between 1997 and 2000. The authors find that charter schools that focus on at-risk students provided slightly more "value added" than conventional public schools, while non-at-risk charters provided slightly less value added than conventional schools. They also examine the relative age of the charter schools and find that schools with two or more years of experience produced better academic outcomes. However, Hanushek, Kain, and Rivkin (2002) draw different conclusions from similar Texas achievement data. The authors examine student-level TAAS test scores for 200,000 students in grades four through seven between 1996 and 2001. The authors estimate a student-level fixed-effects model. The findings show that charter school students do significantly worse than public school students for new charters, but that charter students do as well as conventional public school students for charters that are at least two years old. In addition, the authors find no significant systematic difference in charter school effects for students of different race or ethnic groups.

Bettinger (2004) compares the test scores of charter and conventional public school students in Michigan. Using nonlongitudinally linked student-level data, he compares 33 charter schools that opened in 1996–1997 with approximately 550 public schools within five miles of these charter schools. Bettinger estimates average school test scores as a function of charter school status and other school-level covariates and generally finds no significant differences in test scores for charter and conventional public school students.[9]

[8] Research in education has long identified the problem with estimating student performance in programs in which students and their families choose to participate. Researchers often try to deal with issue by estimating the selection process, using randomized designs, and fixed-effect approaches (Heckman, 1979; Neal, 1997; Hanushek, Kain, & Rivkin, 2002; Bifulco & Ladd, 2003; Zimmer et al., 2003).

[9] In some of Bettinger's more detailed analysis, he finds that charter schools students made small but insignificant test score gains compared with comparable students in neighboring schools.

A second study in Michigan by Eberts and Hollenbeck (2002) examines the performance of Michigan's charter schools relative to conventional schools using longitudinally linked student-level data. Because the authors did not have data of consecutive years of the same subject tests, they were forced to use fourth-grade math and fifth-grade science test scores to measure gains of individual students, which adds noise to their measurement. The analysis examines the tests scores for 1996–97 through the 2000–01 school years. Using a fixed-effect approach, the study finds that students attending charter schools are not reaching the same level of achievement as students in conventional public schools within the same districts.[10]

More recently, Bifulco and Ladd (2003) use longitudinally linked student-level data to estimate the impact of charter schools in North Carolina for 1995–96 to 2001–02 school years. The authors find that student performance in charter schools is significantly worse than the performance of similar students in conventional public schools.

Finally, Zimmer et al., (2003) examine the effect of student performance in charter schools in six prominent districts in California using longitudinally linked student-level data from 1997–98 through 2001–02 school years. Using a fixed-effect approach to estimate the effects of charter schools for reading and math, the authors conclude that charter schools are performing generally as well as conventional public schools across different grades and subjects.

The inconsistency of these results may be partially explained by varying charter laws and charter school types across states. Most of the above studies also showed age as an important contributing factor. Our current analysis builds upon these studies but disaggregates the findings by charter school types and age.

DATA

The California Department of Education (CDE) provided individual records for all California students that took the Stanford 9 from 1998 through 2002.[11] The test is administered in the spring of each year at elementary and secondary schools. Test scores are measured in terms of the percentile normal curve equivalent based on the Stanford 9 norming sample. If, for example, a student is in the 45th percentile for math in the third grade and the 50th percentile for the fourth grade, then the student's achievement level is growing relative to his/her grade cohort. The analysis divided students into elementary- (grades 2 through 5) and secondary-level (grades 6 through 11) groups. The main limitation of the data is that they do not provide a student-level identifier to track year-to-year changes in a student's test scores. Individual identifiers are important for this type of analysis because they would allow the analysis to isolate a baseline achievement level for individual students. Baseline achievement would allow the analysis to better adjust for the unmeasured background of students that has an ongoing effect on their achievement. Nevertheless, it does represent one of the most comprehensive data sets of charter schools ever compiled.

Table 2 shows the means of background characteristics and test score percentiles for students in conventional and charter schools in California. The file contains 8.9

[10] The authors also include school-level policy variables such as school and classroom size and expenditures per pupil. By controlling for these factors, the study may actually take away key advantages or disadvantages of charter schools.

[11] Starting 2002–03, CDE is switching from the Stanford 9 to the California Achievement Tests, 6th Edition (CAT/6). Therefore, our data sets include the full range of test scores for the Stanford 9.

Table 2. Means of student background characteristics and test score percentile for elementary and secondary students by charter school status.

	Elementary		Secondary	
Variable	Conventional	Charter	Conventional	Charter
Low English proficiency	0.2862	0.2374	0.1789	0.1009
Race/ethnicity				
White non-Hispanic	0.3567	0.3744	0.3902	0.4467
Black	0.0860	0.1834	0.0821	0.1552
American Indian	0.0087	0.0126	0.0099	0.0165
Asian	0.0757	0.0321	0.0866	0.0317
Filipino	0.0237	0.0116	0.0275	0.0261
Hispanic or Latino	0.4365	0.3706	0.3874	0.2953
Pacific Islander	0.0070	0.0041	0.0072	0.0068
Other ethnicity	0.0057	0.0113	0.0091	0.0217
Parental education				
Non-high school graduate	0.2112	0.1687	0.1937	0.1447
High school graduate (only)	0.2690	0.2599	0.2136	0.2209
Some college	0.2321	0.2323	0.2373	0.2608
College graduate	0.1906	0.2195	0.2430	0.2709
Graduate school	0.0971	0.1195	0.1124	0.1026
Free/reduced school lunch	0.6487	0.5528	0.4822	0.3317
Female	0.4892	0.4960	0.4868	0.4978
1st year at school	0.1908	0.2892	0.4067	0.5641
Test score percentile				
Reading	44.0	43.3	42.1	40.9
Math	49.3	46.5	47.8	42.7
Number of schools				
1998	5503	79	3623	56
1999	5548	103	3659	96
2000	5630	142	3784	134
2001	5749	185	3924	193
2002	5802	225	4094	248
Observations (student years)	8,980,406	134,218	12,455,595	191,700

Note: All variables except test score percentiles are indicator variables, so the means are proportions. Some schools include elementary and secondary grades, and these schools are counted in both groups in Tables 2, 3, and 4.

million elementary and 12.4 million secondary student-year records. About 1.5 percent of both the elementary and secondary students are enrolled in a charter over this five-year period. While the share of charter schools is small, the file contains about 326,000 student-year records. The student characteristics include information on English learner status, race/ethnicity, parent's education, school lunch eligibility, and student mobility (that is, whether the student is in the first year at his/her current school). Parent's education is an important indication of the student's socioeconomic status (SES) that may complement the information available for school lunch eligibility for low-end SES students.[12] Later in the analysis, these vari-

[12] Students were asked to report the education level of the most educated parent or guardian with whom they reside. The categories were non-high-school graduate, high school graduate, some college (including AA degree), college graduate, and graduate school.

ables are used to adjust test scores for the effect of student background. The file also identifies the student's school and grade in school.

The means in Table 2 show that math and reading scores are slightly lower in charter schools than in conventional public schools, but the two sectors are educating students with different backgrounds. On average, charter schools have a higher percentage of White non-Hispanic and Black students and a lower percentage of Hispanic and Asian students than conventional public schools. Charter schools have fewer students with low English proficiency and fewer students participating in the free/reduced student lunch program.[13] The parents of charter students are slightly better educated than those of conventional public school students. Student mobility rates are somewhat high in California conventional public schools, at 19 and 41 percent for elementary and secondary students, respectively.[14] Mobility rates are higher for charter students, who are likely to have transferred from a conventional public school, than for students in conventional public school.

Table 2 also shows the sharp increase in the numbers of elementary and secondary charter schools between 1998 and 2002. Over the five years, the number of elementary and secondary school charters rose 285 and 443 percent, respectively.[15]

Tables 3 and 4 show how mean student demographic characteristics and test scores differ with charter school type. Nonclassroom-based students have much higher SES than do students in classroom-based schools (that is, parental education levels are higher and free/reduced lunch rates are much lower). The average test scores of nonclassroom-based students are generally lower than those of classroom-based students.

Classroom-based conversion and startup schools serve somewhat different communities, and demographic characteristics vary considerably across elementary and secondary grades. At the elementary grade levels, conversion students are more likely to be Hispanic and have low English proficiency than are students in startup schools. More conversion students in elementary grades are drawn from low-SES families than are the students of startup schools. Demographic patterns are somewhat different for secondary students than for elementary students. Hispanic students are equally represented in classroom-based conversions and startups, but conversions enroll a larger proportion of Black students and a smaller proportion of White non-Hispanic students than do startup schools. The parental education of conversion and startup secondary students is similar, but more conversions students are eligible for the free/reduced school lunch program.

Students in classroom-based startup schools have higher average test scores than do students in classroom-based conversion schools. In large part, this gap in average scores is expected, because startup students are drawn from demo-

[13] However, a number of charter schools do not participate in the federal free- and reduced-lunch program, which may mask the true poverty rates in charter schools (Zimmer et al., 2003).

[14] The secondary school mobility rate reflects the fact that many students must change from elementary school to middle school and then from middle school to high school, because their current school does not continue to the next highest grade level.

[15] For our analysis, we defined elementary schools as schools that have test scores for students in fifth grade and below and defined secondary schools as schools that have test scores for student in sixth grade or above. In some cases, charter schools include a combination of the two and are counted as separate schools in Table 1. For instance, some charter schools are K–12 and are counted both as elementary and secondary schools.

Table 3. Means of student characteristics and test score percentile for different types of elementary charter schools.

	Conversion Charters		Startup Charters	
Variable	Classroom-Based	Nonclassroom-Based	Classroom-Based	Nonclassroom-Based
Low English proficiency	0.3094	0.0136	0.1225	0.0102
Race/ethnicity				
White non-Hispanic	0.2865	0.7013	0.4544	0.7398
Black	0.2033	0.0430	0.1809	0.0636
American Indian	0.0052	0.0997	0.0318	0.0207
Asian	0.0354	0.0290	0.0298	0.0188
Filipino	0.0126	0.0034	0.0099	0.0116
Hispanic or Latino	0.4506	0.1057	0.2746	0.0917
Pacific Islander	0.0039	0.0034	0.0038	0.0048
Other ethnicity	0.0026	0.0145	0.0149	0.0491
Parental education				
Non-high school graduate	0.2264	0.0857	0.0700	0.0248
High school graduate (only)	0.3058	0.2146	0.1726	0.1553
Some college	0.1936	0.2755	0.2945	0.3409
College graduate	0.1791	0.2739	0.2916	0.3129
Graduate school	0.0951	0.1504	0.1713	0.1661
Free/reduced school lunch	0.6874	0.2548	0.3860	0.0549
Female	0.4939	0.4977	0.5054	0.4989
1st year at school	0.1988	0.4897	0.4281	0.5898
Test score percentile				
Reading	42.7	45.6	48.1	44.9
Math	47.3	43.0	49.6	42.0
Number of schools				
1998	28	7	21	23
1999	52	7	21	23
2000	58	10	38	36
2001	66	12	60	47
2002	74	15	74	62
Observations (student years)	89,649	2,347	19,021	16,605

Note: All variables except test score percentiles are indicator variables, so the means are proportions. Some schools include elementary and secondary grades, and these schools are counted in both groups in Tables 2, 3, and 4.

graphic groups that consistently score higher on student achievement tests. The reading and math scores for classroom-based conversions are slightly lower than the scores for students in conventional public schools. The average test scores of startup students are higher than those of students in conventional public schools.

While charters remain small in number relative to conventional public schools, the number of new schools has more than doubled for each type of charter at both the elementary and secondary grade levels. The biggest growth has been in startup schools over the five-year period—the increase in classroom- and non-classroom-based startups at the secondary level has been 662 and 467 percent, respectively.

Table 4. Means of student characteristics and test score percentile for different types of secondary charter schools.

	Conversion Charters		Startup Charters	
Variable	Classroom-Based	Nonclassroom-Based	Classroom-Based	Nonclassroom-Based
Low English proficiency	0.1779	0.0349	0.1071	0.0262
Race/ethnicity				
White non-Hispanic	0.3047	0.6001	0.4198	0.5897
Black	0.2527	0.0487	0.1332	0.0788
American Indian	0.0071	0.0443	0.0198	0.0214
Asian	0.0409	0.0117	0.0420	0.0184
Filipino	0.0417	0.0048	0.0146	0.0189
Hispanic or Latino	0.3405	0.2625	0.3443	0.2256
Pacific Islander	0.0059	0.0038	0.0061	0.0084
Other ethnicity	0.0064	0.0243	0.0202	0.0390
Parental education				
Non-high school graduate	0.1544	0.1661	0.1573	0.1234
High school graduate (only)	0.1975	0.2722	0.1872	0.2534
Some college	0.2390	0.2611	0.2464	0.2911
College graduate	0.2898	0.2367	0.2713	0.2593
Graduate school	0.1192	0.0640	0.1378	0.0728
Free/reduced school lunch	0.4984	0.2559	0.3984	0.1531
Female	0.4912	0.4563	0.4993	0.5162
1st year at school	0.4186	0.7227	0.5704	0.6960
Test score percentile				
Reading	42.0	34.7	44.4	39.0
Math	46.1	35.9	46.5	38.4
Number of schools				
1998	15	7	16	18
1999	25	8	30	33
2000	28	13	43	50
2001	33	15	76	69
2002	40	18	106	84
Observations (student years)	75,676	9,262	33,724	66,637

Note: All variables except test score percentiles are indicator variables, so the means are proportions. Some schools include elementary and secondary grades, and these schools are counted in both groups in Tables 2, 3, and 4.

ANALYSIS

In many cases, charter schools have a number of contractual goals in terms of performance measures, including, but not limited to, test scores. Indeed, previous research has found that charter schools have goals that include offering a wider array or more specialized curriculum (Henig et al., 2003; Zimmer et al., 2003). Nevertheless, test scores continue to be the predominant measure of success for charter schools. In addition, test scores are consistently used by parents, policymakers, and the general public as key indicators for performance and continue to have significant implications for both charter and conventional public schools. In this current analysis, we use California Department of Education's Stanford 9 test scores as the outcome measure.

The analysis on the following pages is divided into subsections reflecting alternative dimensions of charter schools.

Comparison of Charter and Conventional Public Schools

A simple comparison of average test scores in charter and conventional public schools is misleading because charter students are not a random sample of public school students in the state. For example, charters may enroll a disproportionate number of low-achieving students initially or be located in areas with high concentrations of at-risk students. To adjust for these factors, our model estimates the performance of each observed student score as a function of student characteristics as well as a time-trend variable and the type of school the student attends. At the core of our analysis is the performance of different types of schools. Some schools may inherently do better than others because they have better facilities, stronger links to the community, a dynamic principal, or other factors unique to an individual school. Many of these school-specific factors are difficult to measure, so the model simply estimates an effect for school type (that is, charter versus conventional public school) based on the type of school the student attends and allows for composite or aggregate differences in achievement from school-to-school. Finally, groups of students move through each school in grade cohorts, so if the third-grade class at a particular elementary school excels (relative to classes with students from similar backgrounds) in one year, then the fourth-grade class in the same school the next year is likely to excel as well. These three factors (student background, school-specific effects, and grade cohort within school effects) are incorporated in our statistical model as controls for factors other than charter status that are likely to affect student achievement. The model is based on Equation (1):

$$s_{ijkt}=\alpha_j+\delta_{k(j)}+\gamma C+x_{ijkt}\beta+\nu_{ijkt} \tag{1}$$

where i, j, k, and t index individual students, schools, grades, and years, respectively; s is test score for each individual student across all schools and all years; α is an unobserved school-specific factor that does not vary over time; δ is an unobserved grade-cohort factor within each school; γ is an unobserved parameter reflecting the possible effect of charter school attendance on s; C is an indicator variable that equals one if the school is a charter school and zero otherwise, x is a $1 \times K$ vector of K observable factors affecting s, β is a $K \times 1$ vector of unobserved parameters, and ν is a random error term. The model includes a set of indicator variables for test year to allow for possible trends in the scores (the year fixed effect is incorporated in x).

The key variable in the model is γ, which shows the effect of charter school attendance for individual students after controlling for other factors in the model. The model adjusts for differences in the background characteristics for students attending different schools as well as for school and grade-cohort random effects within each school.

The results in Tables 5 and 6 show small differences in student achievement between charters and conventional schools. Table 5 shows no significant difference between charter and conventional schools for elementary reading. Other things equal, charter school students score about 1.44 percentile points lower in elementary math than their counterparts in conventional schools. Table 6 shows that, at the secondary level, test scores for charter school students are significantly lower for both secondary reading and math by 1.45 and 2.25 percentile points, respec-

Table 5. Stanford 9 test regressions for elementary conventional public schools and charter students in state.

	Reading		Math	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	44.6446*	0.103	48.7307*	0.1168
Charter	0.1315	0.2082	–1.4453*	0.2264
Low English proficiency	–10.8959*	0.0181	–7.2042*	0.0191
Ethnicity				
Black	–9.3119*	0.0271	–10.9518*	0.0288
American Indian	–4.6607*	0.0683	–4.7767*	0.0725
Asian	3.501*	0.0281	9.3518*	0.0298
Filipino	1.1189*	0.044	2.7861*	0.0466
Hispanic or Latino	–4.2393*	0.0193	–3.6057*	0.0204
Pacific Islander	–4.4771*	0.0754	–4.009*	0.0799
Other ethnicity	–2.3555*	0.0836	–1.907*	0.0886
Parental education				
Non-high school graduate	–2.5158*	0.0225	–2.0535*	0.0239
Some college	3.976*	0.0212	3.7894*	0.0225
College graduate	7.1067*	0.0235	7.0327*	0.0249
Graduate school	11.2917*	0.03	10.838*	0.0318
Free/reduced school lunch	–4.4945*	0.0204	–4.4966*	0.0217
Female	2.9643*	0.0123	0.4553*	0.013
1st year at school	–3.8241*	0.017	–4.1611*	0.018
Testing year				
1999	3.6135*	0.0222	3.5542*	0.0237
2000	5.407*	0.0311	5.7928*	0.0333
2001	5.1517*	0.0325	5.1454*	0.0349
2002	4.7355*	0.0345	4.9815*	0.0372
Random effects				
School	56.3047	1.1766	72.9590	1.5542
Grade cohort within school	12.0444	0.1189	20.8382	0.1960
R-square	0.5822		0.4736	

Note: Entries with asterisks are associated with coefficients that are significantly different from zero at the $\alpha = 0.05$ confidence level. The r-square statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk & Raudenbush, 2002). Sample size is 9,114,624 student records.

tively. These results generally suggest that charter school students have slightly lower scores than do comparable students at conventional schools.

As expected, student background characteristics had substantial effects on test scores. The regression results show an inverse relationship between students of low English proficiency, minority status, and participation in free/reduced lunch. Students who are new to their current school tend to score lower than students who attended the same school in the previous year. Other things equal, girls tend to score

Table 6. Stanford 9 test regressions for secondary school conventional public schools and charter students in state.

	Reading		Math	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	44.4395*	0.1222	49.4443*	0.1374
Charter	–1.4594*	0.2531	–2.2585*	0.2752
Low English proficiency	–14.6019*	0.0159	–9.5794*	0.0166
Ethnicity				
Black	–11.2297*	0.0219	–11.7061*	0.023
American Indian	–5.6383*	0.0526	–5.6541*	0.0552
Asian	2.5423*	0.0215	10.953*	0.0225
Filipino	–0.888*	0.0335	1.9182*	0.0351
Hispanic or Latino	–4.966*	0.0152	–4.7537*	0.016
Pacific Islander	–6.1852*	0.0613	–4.3319*	0.0643
Other ethnicity	–4.7052*	0.0549	–3.8133*	0.0576
Parental education				
Non-high school graduate	–0.6521*	0.019	0.0798*	0.0199
Some college	4.8375*	0.0176	4.1821*	0.0184
College graduate	6.6355*	0.018	6.3701*	0.0189
Graduate school	13.4157*	0.0229	13.1819*	0.024
Free/reduced school lunch	–3.8896*	0.016	–3.2559*	0.0168
Female	3.0186*	0.0102	0.0021	0.0107
1st year at school	–1.8028*	0.0139	–1.227*	0.015
Testing year				
1999	1.476*	0.0202	0.831*	0.0216
2000	1.2207*	0.0308	0.3641*	0.0331
2001	0.5712*	0.0337	–1.0285*	0.037
2002	–0.7843*	0.0371	–3.3241*	0.0414
Random effects				
School	95.0733	1.7159	119.4900	2.1846
Grade cohort within school	9.0684	0.1115	21.5861	0.2375
R-square	0.4045		0.3085	

Note: Entries with asterisks are associated with coefficients that are significantly different from zero at the $\alpha = 0.05$ confidence level. The r-square statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk & Raudenbush, 2002). Sample size is 12,647,295 student records.

higher than boys, but the effect is insignificant for secondary math. Finally, student test scores are positively related to the level of their parent's education.

In addition to the random effect for school and grade cohort within a school, the model also controls for the trend in achievement scores over the five-year time period. The results show that elementary students did somewhat better in 1999 and 2000 compared to 1998, but the trend has been rather flat or slightly negative since 2000. For secondary students, the upward trend was smaller in 1999 and 2000, and it has become negative since then.

Comparison of Different Types of Charter Schools

The student achievement model is expanded to examine the performance of alternative types of charter schools. The analysis examines differences between conversion and startup charter schools, the two major classifications of charter schools in California and across the nation, and then by classroom- and nonclassroom-based charter schools. These types of charter schools have distinctive characteristics, so student achievement may differ across these types of charter schools. For instance, conversion schools typically use the same building, same teachers, and many of the same curriculum and education programs as before, whereas startups use new facilities, hire new teachers, and often adopt distinctive curriculum and education programs. Nonclassroom-based charter schools often use a philosophy of "individualized learning plans" to educate students, while classroom-based charter schools use a more systematic approach. These differences among charter schools should lead to differences in performance.

The expanded student achievement model adds separate effects for different types of charter schools:

$$s_{ijkt} = \alpha_j + \delta_{k(j)} + \sum_{m=1}^{n} \gamma_m C_m + x_{ijkt}\beta + \nu_{ijkt} \qquad (2)$$

where γ_m represents the effect of the *m*th type of charter school relative to conventional public schools and *n* is the number of alternative charter school types in the model. Several models are considered:

1. A model that separates the performance of conversion and startup charter schools in which the parameter estimates of γ_1 and γ_2 reflect the effect on student achievement of students attending conversion schools (C_1) startup schools (C_2).
2. A more general model that examines how classroom- and nonclassroom-based instruction affects achievement in conversions and startups. C is decomposed into four elements corresponding to the charter schools estimating the effect from conversion classroom-based and nonclassroom-based charter schools and startup classroom-based and nonclassroom-based charter schools relative to conversion schools with only classroom instruction, conversion schools with nonclassroom-based instruction, startup schools with only classroom instruction, and startup schools with nonclassroom-based instruction.[16]

Tables 7 and 8 summarize the effects of different charter types on the test scores of elementary and secondary students, respectively. Most students are enrolled in conventional public schools, so the estimated parameter estimates for the demographic factors in the expanded model differ little from those in Tables 5 and 6.

[16] We should once again note that not all students who attend a nonclassroom-based charter school receive nonclassroom-based instruction. In addition, our data do not distinguish whether a particular student uses any form of nonclassroom instruction, but we do know which charter schools offer these programs. A RAND survey of charter schools collected information on the percentage of students that receive instruction at the school site (Zimmer et al., 2003). Using these responses, we estimate that about 63 percent of students in a school with nonclassroom-based instruction receive at least some instruction away from the formal school site.

Table 7. Stanford 9 test regressions for elementary students by charter school type.

	Reading		Math	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Model 1 **Comparison of Conversion and Startup Schools**				
Charter type				
Conversion charter	0.9785*	0.2257	–0.6024*	0.2441
Startup charter	–4.6627*	0.5346	–6.5341*	0.5962
R–square	0.5830		0.4775	
Model 2 **Comparison of Classroom- and Nonclassroom-Based Charter Schools**				
Charter type				
Conversion and classroom	1.0123*	0.2354	–0.5147*	0.2546
Conversion and nonclassroom	–4.325*	1.6449	–9.1836*	1.843
Startup and classroom	0.9871	0.932	–1.4994	1.0613
Startup and nonclassroom	–7.5771*	0.6995	–9.129*	0.7723
R-square	0.5848		0.4803	

Note: Entries with asterisks are associated with coefficients that are significantly different from zero at the $\alpha = 0.05$ confidence level. The r-square statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk & Raudenbush, 2002). Sample size is 9,114,624 student records.

Therefore, the results in Tables 7 and 8 do not show the estimated parameter estimates for demographic factors in the expanded achievement model.

The elementary school results from the first model show that conversion charter schools have a small, positive effect on reading and a small, negative effect on math compared to conventional public schools. The results show that student in startup schools score about 5 to 7 percentage points lower than do similar students in conventional public schools.

The results from the second model in Table 7 show the importance of separating charter schools with classroom- and nonclassroom-based instruction. Students in nonclassroom-based conversion and startup schools have much lower test score than do comparable students in conventional public schools. Classroom-based charters are keeping pace with conventional public schools—the test scores in classroom-based conversions are one percentage point higher in reading one point lower in math, while startup scores do not differ significantly from those in conventional schools.

Table 8 displays the results of the two models for secondary students. The results from the first model show that startup school students have lower reading and math scores than do comparable students in conventional public schools. The conversion coefficients are insignificant for reading and negative for math.

The results from the second model in Table 8 show that nonclassroom-based schools are pulling down the average test scores for both conversion and startup schools. Nonclassroom-based charter schools are performing poorly compared with conventional public schools. Classroom-based conversion schools have mixed

Table 8. Stanford 9 test regressions for secondary students by charter school type.

	Reading		Math	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Model 1 Comparison of Conventional and Startup Charter Schools				
Charter type				
Conversion charter	–0.0062	0.3065	–1.2442*	0.332
Startup charter	–4.5596*	0.4469	–4.4677*	0.4894
R-square	0.4045		0.3085	
Model 2 Comparison of Classroom-Based and Nonclassroom-Based Charter Schools				
Charter type				
Conversion and classroom	0.1084	0.3094	–1.0962*	0.335
Conversion and nonclassroom	–4.3659	2.3507	–8.0897*	2.6461
Startup and classroom	2.7535*	0.8936	2.0399*	1.0097
Startup and nonclassroom	–7.2532*	0.5486	–6.8754*	0.594
R-square	0.4093		0.3123	

Note: Entries with asterisks are associated with coefficients that are significantly different from zero at the $\alpha = 0.05$ confidence level. The r-square statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk & Raudenbush, 2002). Sample size is 12,647,295 student records.

results—the reading score is no different than in conventional public schools, but the math score is slightly lower. The test scores for classroom-based startups are higher than those of conventional public schools, after adjusting for the mix of students attending these schools.

The evidence shows important differences in test score performance across different types of charter schools, but the underlying reasons for these differences are not clear without greater analysis of the operation of these schools. The reasons may reflect differences across these school types in instruction, curricula, general education missions, the relative differences in expenditures, or other institutional factors such as differing chartering arrangements with their chartering authority (Henig et al., 2003). In addition, the schools may differ from one another in the types of students that they attract. For instance, nonclassroom-based students may be different in unique ways from students in conventional public schools that are not captured by the demographic factors in the analysis. More explicitly, if nonclassroom-based students have been pulled out of conventional public schools because of problems in traditional settings, then conventional students who do not have these problems do not make a good comparison group. With longitudinally linked student-level data, an analysis would be better able to control for these unobservable differences. Nevertheless, the differences in performance among charter schools in our analysis are compelling and underscore the importance of considering these differences when interpreting charter school results.

Charter Schools Over Time

We now turn our attention to the effect of these various types of charter schools over time. By any measure, starting a school is a challenging endeavor, which suggests that the performance of charter schools may change as the school evolves. This may be especially pronounced for startup schools that have to hire new staff, find suitable facilities, and develop curriculum programs. Also, nonclassroom schools are distinct, with little to no models to rely upon. Presumably, many of these schools evolve over time through trial and error. Thus, we would expect differences in performance among these various types of charter schools as they mature. To conduct the analysis, we expand upon Equation 2 by adding terms to estimate whether new charter schools performed differently from established charter schools. We examined whether the academic achievement of students in charters that were less than three years old was higher or lower than for older charter schools of the same type. Equation 2 was modified to allow for different effects of new and established charter schools of each type:

$$s_{ijkt}=\alpha_j+\delta_{k(j)}+\sum_{m=1}^{4}\gamma_m C_m+\sum_{m=1}^{4}\tau_m CN_m+x_{ijkt}\beta+\nu_{ijkt} \tag{3}$$

where τ_1 through τ_4 show the effect of a new charter relative to an established charter of the same type; τ_1 is for new conversion schools with only classroom instruction; τ_2 is for new conversion schools with nonclassroom-based instruction; τ_3 is for new startup schools with only classroom instruction; and τ_4 is for startup schools with nonclassroom-based instruction. The variables CN_1 through CN_4 are corresponding indicator variables for whether the student's charter school is a new conversion with classroom-based instruction, a new conversion with nonclassroom-based instruction, a new startup with classroom-based instruction, or a new startup with nonclassroom-based instruction. Thus, for each type of charter, we compare the scores of comparable students in charter schools that are less than three years old ("new charters") with those of established charters. The results are presented in Table 9.

The table suggests that the performance of new charters differs somewhat from that of established charters. For elementary students, new classroom-based conversion schools have test scores about 1.4 percentage points lower than established classroom-based conversion schools in reading. In new startups with nonclassroom-based instruction, test scores in reading and math were 4.9 and 7.0 points higher, respectively, than for similar established startups with nonclassroom-based instruction. The scores for conversions with nonclassroom-based instruction (a very small group) and for classroom-based startup schools did not differ significantly between new and established schools.

At the secondary level, new schools generally perform better than established ones. In math, new conversion schools had test scores that were about 2 percentage points higher than for similar established conversion schools. In reading, the test scores were 1 and 4 percentage points higher in new classroom- and nonclassroom-based conversions, respectively, than in older schools. After controlling for demographic differences in their students, new startups with nonclassroom-based instruction had test scores 5 and 4 percentage points higher in reading and math, respectively, than for established charters with nonclassroom-based instruction. In contrast, new startups without nonclassroom-based instruction had test scores one and two percentage points lower in reading and math, respectively, than established classroom-based startup schools.

Table 9. Stanford 9 test regressions for elementary students by charter school type.

	Reading		Math	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
		Elementary Schools		
Charter type				
Conversion and classroom	2.0953*	0.2943	–0.3194	0.3203
Conversion and nonclassroom	–3.2656	2.0604	–7.2377*	2.3009
Startup and classroom	1.302	0.9749	–1.2484	1.1055
Startup and nonclassroom	–11.1117*	0.785	–14.316*	0.8652
New school interactions				
Conversion and classroom	–1.3504*	0.2200	–0.2399	0.2366
Conversion and nonclassroom	–1.6141	1.8861	–2.9273	2.0635
Startup and classroom	–0.5102	0.4592	–0.4220	0.4954
Startup and nonclassroom	4.866*	0.4888	7.0287*	0.5275
R-square	0.5848		0.4803	
		Secondary Schools		
Charter type				
Conversion and classroom	–1.0317*	0.4114	–3.0567*	0.4541
Conversion and nonclassroom	–6.4467*	2.4144	–9.1315*	2.7096
Startup and classroom	3.4601*	0.9355	3.4577*	1.0521
Startup and nonclassroom	–11.3438*	0.5833	–9.9201*	0.6319
New school interactions				
Conversion and classroom	1.2833*	0.3064	2.1304*	0.3336
Conversion and nonclassroom	4.6782*	1.2066	2.3251	1.3098
Startup and classroom	–1.1484*	0.4215	–2.2515*	0.4554
Startup and nonclassroom	5.3343*	0.2578	3.9015*	0.2763
R-square	0.4171		0.3115	

Note: Entries with asterisks are associated with coefficients that are significantly different from zero at the $\alpha = 0.05$ confidence level. The r-square statistic shows the reduction in the variance components for this model relative to an unconditional mean model that only adjusts for the two random effects (Bryk & Raudenbush, 2002). Sample size is 9,114,624 student records for elementary schools and 12,647,295 student records for secondary schools.

These results are somewhat surprising and suggest a complex picture of charter school performance over time in which some types of charter schools do improve their performance over time—but not all of them. One might expect that older charter schools would consistently perform better than new charter schools. However, our analysis may be picking up a "vintage" effect in which newer schools have learned from the past mistakes of older established charter schools or have adopted more successful educational programs from the outset. This may be especially true for nonclassroom-based schools in which the design and the use of technology is evolving quickly, making newer schools more adept at educating students. Whatever the explanation, the results again raises questions about uniformly examining the performance of charter schools, even when looking at the performance of charter schools over time.

CONCLUSIONS

Currently, 37 states plus the District of Columbia have actively operating charter schools and many more states have either legislatively adopted or are legislatively considering charter schools. Policymakers in these states may look to the existing research to draw conclusions about the performance of charter schools to make critical policy decisions. However, the previous research has conflicting results with no consensus on charter school performance. Some of the disagreement can be explained by the fact that charter schools vary by state. Also, the age profile of schools may vary from state to state, so the average effect from a state with established charters might provide a distorted picture of how newer charters might perform in another state. One way of reconciling these findings is to distinguish charter schools in each state by charter type and age.

In this current research, we examine the performance of classroom- and nonclassrroom-based startup and conversion charter schools. We also separate our results for new and established charter schools. The results provide state policymakers and educators with more comprehensive information on performance differences among various types and vintages of charter schools. For instance, our analysis suggests that *startup classroom-based* charter schools provide the greatest promise of improving performance while *nonclassroom-based* charter schools are performing poorly, and states may want to approach these schools with some reservations. Also, while most states do have *classroom-based* conversion charter schools, our results suggests that these schools, on average, are performing only on par with conventional public schools and may not lead to significant gains in student performance.

In addition, state policymakers may be concerned about the initial performance of charter schools. However, our research suggests that not all mature charter schools will outperform new charter schools. In fact, our analysis suggests that across the various types of charters most new charter schools outperform mature charter schools. These surprising results may be explained by a vintage effect, by which new charter schools learn from the past mistakes of older charter schools or have developed new educational philosophies that are more effective. Thus, policymakers may want to set up a mechanism for principals of newly created charter schools to interact with principals of more mature charter schools.

Finally, our results may also suggest that it may be very difficult to develop universal conclusions about charter schools nationally as charter school performance varies from state to state, charter type to charter type, and even charter school to charter school. Hopefully, however, our analysis can be a catalyst for other research to open the "black box" further on charter schools and examine the differences in their operation. By doing so, researchers, educators, and policymakers can have a better handle on effective educational strategies not only for charter schools, but for all public schools.

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